

~~CONFIDENTIAL~~

Nº

56

ECONOMIC INTELLIGENCE REPORT

PRODUCTION OF MAIN-LINE LOCOMOTIVES IN THE USSR 1945-58



CIA/RR 59-1

January 1959

CENTRAL INTELLIGENCE AGENCY

OFFICE OF RESEARCH AND REPORTS

~~CONFIDENTIAL~~

WARNING

This material contains information affecting the National Defense of the United States within the meaning of the espionage laws, Title 18, USC, Secs. 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law.

C-O-N-F-I-D-E-N-T-I-A-L

ECONOMIC INTELLIGENCE REPORT

PRODUCTION OF MAIN-LINE LOCOMOTIVES IN THE USSR
1945-58

CIA/RR 59-1

CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

FOREWORD

This report presents an analysis of developments in the Soviet locomotive building industry since World War II and estimates of production of locomotives through 1960. The report is not intended to be a comprehensive study of individual locomotive building plants, except as these plants have contributed to total annual production of locomotives in the USSR.

The estimates of production of locomotives during 1956-60 contained in this report are based on announced goals for the original Soviet Sixth Five Year Plan (1956-60) and the capability of the locomotive building industry of the USSR to meet the goals. Recently the USSR announced that a new long term economic plan covering 1959-65 had been prepared. The evidence currently available indicates that the new plan will make few changes in the goals set for rail transport for the period through 1960. Therefore, throughout this report, it has been assumed that goals for production of locomotives stated in the original Sixth Five Year Plan will remain unchanged.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

CONTENTS

	<u>Page</u>
Summary	1
I. Introduction	2
II. Economics of Locomotives in the USSR	3
III. Structure of the Industry	4
A. Diesel Locomotives	5
1. Transport Machinery Plant at Bryansk	6
2. V.A. Malyshev Transport Machine Building Plant at Khar'kov	6
3. Diesel Locomotive Plant imeni Kuybyshev at Kolomna	7
4. Lugansk Locomotive Building Plant imeni October Revolution	7
B. Electric Locomotives	7
1. Plant imeni Budennyi at Novocherkassk	7
2. Tbilisi Electric Locomotive Building Plant	8
C. Specialization and Cooperation of Plants	8
IV. Production	10
A. Before World War II	10
B. World War II	12
C. Fourth Five Year Plan (1946-50)	13
D. Fifth Five Year Plan (1951-55)	14
E. Original Sixth Five Year Plan (1956-60)	17
1. Diesel Locomotives	21
2. Electric Locomotives	22
V. Research and Development	23
A. Gas-Turbine (GT) Locomotives	23
B. Atomic Locomotives	23
VI. Capabilities, Limitations, and Intentions	25

- v -

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Appendixes

	<u>Page</u>
APPENDIX A. Statistical Tables on Transportation in the USSR and the US	29
APPENDIX B. Statistical Tables on Production of Main-Line Locomotives in the USSR . . .	35
APPENDIX C. Additional Information on Principal Types of Main-Line Locomotives in the USSR	43
APPENDIX D. Photographs of Soviet Main-Line Loco- motives	47
APPENDIX E. Methodology	49

50X1

Tables

1. Estimated Freight Hauled in the USSR and the US, in Percentages, Selected Years, 1940-60	30
2. Estimated Proportion of Passengers in the USSR and the US, by Type of Transportation, Selected Years, 1913-55	31
3. Estimated Freight Hauled in the USSR and the US, in Ton-Kilometers, Selected Years, 1940-56 . . .	32
4. Estimated Increase of Freight Hauled by Main-Line Locomotives in the USSR, 1950-57	33
5. Estimated Production of Main-Line Locomotives in the USSR and the Soviet Bloc, 1949-57	36
6. Estimated Operating Costs of Main-Line Steam and Diesel Locomotives in the USSR, 1954	37

- vi -

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Page

7. Estimated Production of Main-Line Locomotives in the USSR, Selected Years, 1913-55	38
8. Estimated Production of Main-Line Locomotives, Including Diesel Locomotives, in the USSR, Compared with New Main-Line Diesel Locomotives Installed by Class I Railroads in the US, 1945-54	39
9. Estimated Production of Main-Line Steam, Diesel, and Electric Locomotives Required to Meet the Goals of the Original Sixth Five Year Plan in the USSR, 1956-60	40
10. Estimated Production of Main-Line Diesel Locomotives in the USSR, 1945-57	41
11. Estimated Basic Data on Principal Types of Main-Line Locomotives in the USSR	44
12. Estimated Freight Hauled by Principal Types of Main-Line Locomotives in the USSR, Selected Years, 1950-70	45

Illustrations

Following Page

Figure 1. USSR: Interior of the Lugansk Locomotive Building Plant imeni October Revolution (Photograph)	6
Figure 2. USSR: Locations of Locomotive Plants and Component Supply Plants, 1958 (Map) . . .	Inside Back Cover
Figure 3. USSR: Estimated Production of Main-Line Locomotives, Selected Years, 1928-55 (Chart)	10

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Following Page

Figure 4. USSR: Estimated Production of Main-Line Locomotives Required to Meet the Goals of the Original Sixth Five Year Plan, 1956-60 (Chart)	10
Figure 5. USSR: TE-1 Diesel Locomotive (Photograph)	48
Figure 6. USSR: TE-2 Diesel Locomotive (Photograph)	48
Figure 7. USSR: TE-3 Diesel Locomotive (Photograph)	48
Figure 8. USSR: VL-19 Electric Locomotive (Photograph)	48
Figure 9. USSR: VL-22m Electric Locomotive (Photograph)	48
Figure 10. USSR: N-0 Electric Locomotive (Photograph)	48
Figure 11. USSR: N-8 Electric Locomotive (Photograph)	48
Figure 12. USSR: L Steam Locomotive (Photograph)	48
Figure 13. USSR: LV Steam Locomotive (Photograph)	48

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

PRODUCTION OF MAIN-LINE LOCOMOTIVES IN THE USSR*

1945-58

Summary

The Soviet locomotive building industry, as the primary supplier of locomotives to the main-line railroads of the USSR, is one of the most important branches of the Soviet machine building industry. It was planned that, by the last year of the original Sixth Five Year Plan (1956-60),** freight carried by the Soviet railroads would almost equal freight carried in 1956 by the railroads of all other countries of the world and would be more than 1-1/2 times the amount carried in 1956 by the railroads of the US. The Soviet economy depends on rail transport to carry more than 80 percent of the total freight carried in the USSR. The carrying of this freight cannot be transferred in the near future to other means of transportation.

During 1945-54 the Class I railroads*** of the US installed almost 21,000 diesel locomotives on their railroads. The USSR during the same period produced only about 8,000 main-line locomotives of all types, of which only about 700 were diesel locomotives.

To implement the over-all goal of reconstructing the economy, the Soviet Fourth Five Year Plan (1946-50) provided for production of about 7,600 locomotives. Although the Soviet locomotive industry had the capacity to produce this number, it failed to do so, primarily because some of its facilities were shifted in the later years of the plan to production of heavy equipment for hydroelectric projects, navigation canals, and other heavy industries. Although this shift in emphasis continued through the first 2 years of the Fifth Five Year Plan (1951-55), production of locomotives began to increase during the latter years of this plan.

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 October 1958.

** Although the USSR has revised the original Sixth Five Year Plan and issued a 7-year economic plan for 1959-65, the evidence available to date indicates that the new plan will make few changes in the goals to be achieved by rail transport for the period through 1960. Therefore, throughout this report, it has been assumed that goals for production of locomotives stated in the original Sixth Five Year Plan will remain unchanged.

*** The term Class I railroad as used in this report refers to railroads having annual operating revenues of more than US \$1 million.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

By 1955 it was decided to shift production from steam locomotives to diesel and electric locomotives because it was estimated that this conversion would save the equivalent of more than 50 million tons* of coal in 1960 alone. Under the original Sixth Five Year Plan the locomotive industry was to produce 4,500 diesel locomotives compared with 853 diesel locomotives produced from the end of World War II through 1955 and 2,000 electric locomotives compared with 1,175 electric locomotives produced from the beginning of 1932 through 1955. This increased production was to be accomplished by the conversion of two plants from production of steam locomotives to production of diesel locomotives, by better organization, by increased efficiency of labor, and by added capacity at all plants. It was expected that, by the end of the original Sixth Five Year Plan, diesel and electric locomotives would contribute about 40 percent of the total tractive work. This proportion was to increase to 80 to 85 percent by 1965 and to 100 percent by 1970. Electric locomotives were to account for about 60 percent of this work in 1970. Delays in the conversion of production from steam locomotives to diesel and electric locomotives now make it unlikely that the USSR will achieve its original Sixth Five Year Plan for production of locomotives.

Future production of the industry will depend to a great extent on its ability to obtain supplies, when needed, from plants engaged in the program of "cooperation and specialization" in support of the locomotive industry. The locomotive industry in the USSR would be vulnerable to the disruption of production of these plants or of shipments from them. Furthermore, the involvement of the USSR in a war, as either a major supplier of arms to another power or a direct participant, probably would result in severe curtailment or cessation of production of locomotives in the USSR.

Production of an atomic locomotive has been mentioned in Soviet periodicals, but such a locomotive if produced in the current period probably would be produced for its propaganda value rather than for its economic value.

I. Introduction.

In industrialized economies such as those of the US and the USSR, rail transport is of primary importance in both peace and war. In spite of the increased use in recent years of transportation by air

* Tonnages are given in metric tons throughout this report.

In the USSR, where the highway system is relatively underdeveloped compared with those of most Western nations and where in 1957 the average length of haul of railroad freight from the place of production to the place of consumption was 819 kilometers (km), 1/** rail transport is especially important. Since 1928, rail transport has been the means of moving at least 75 percent of the freight and more than 80 percent of the passengers transported within the territorial limits of the USSR.

In addition to supplying Soviet railroads with most of their locomotives, the Soviet locomotive plants have the important quality of being more easily converted to production of heavy armaments, tanks, and armored gun carriages than do many other civilian production facilities. During World War II, for example, some of the locomotive plants of the USSR produced T-34 tanks, and it is believed that the Khar'kov plant currently may be producing tanks. 4/

The type of locomotive used by railroads greatly affects the amount and types of resources consumed and the efficiency of operation. The four principal types of locomotives now used or under consideration in the USSR are steam, diesel, electric, and gas turbine (GT).**** Coal is important in the choice of type of locomotive, 25 percent of the coal mined in the USSR being used by railroads. Of this quantity, 80 percent

**** For basic data on principal types of modern Soviet main-line locomotives, see Table 11 (Appendix C, p. 44, below).

- 3 -

50X1
50X1

50X1

C-O-N-F-I-D-E-N-T-I-A-L

is used by steam locomotives. Of the freight carried by railroads in 1956, 5.5 percent was coal for railroads. 5/

The steam locomotive, which will continue to be the most important locomotive in the USSR through 1960, has the lowest efficiency of the four principal types, using only about 5 to 7 percent of the potential energy in the coal it consumes. Diesel fuel, however, was relatively scarce until the early 1950's, and Soviet leaders therefore thought it expedient to use coal-burning steam locomotives. In addition, steam locomotives ran long after repairs were due, with the result that, although Soviet railroad traffic was increased (see Table 4*), production of locomotives in the USSR and in the Soviet Bloc (see Table 5**) could be and was curtailed.

In September 1955, Soviet leaders decided in favor of rapid dieselization and electrification of railroads. The diesel locomotive uses 24 to 30 percent of the potential energy of its fuel, and its total operating cost (see Table 6***) is about 39 percent of the cost of a steam-operated locomotive. The electric locomotive is used increasingly in the USSR because its efficiency is calculated to be, depending on the source of electricity, from 16 to at least 60 percent and because its saving of fuel is 60 to 70 percent of that of the steam locomotive. According to Soviet statistics, electric locomotives reduced operating costs enough to pay the capital expenditure for their installation. 6/ The GT locomotive, which may be ready for "mass introduction" on Soviet railroads in 1960, 7/ uses 16 to 33 percent of the energy made available to it, depending on the temperature of the gas at the turbine.

III. Structure of the Industry.

Although the Soviet locomotive plants have been subordinate to various peoples commissariats and ministries,**** these plants consistently have retained the design and production of locomotives as their principal activity and are among the oldest industrial enterprises in the USSR. 8/ During most of the Communist regime the plants (with the exception of the Plant imeni Budennyi at Novocherkassk and the Tbilisi Electric Locomotive Building Plant) have been subordinate to the Main Administration of Locomotives, which in turn was subordinated successively to various

* Appendix A, p. 33, below.

** Appendix B, p. 36, below.

*** Appendix B, p. 37, below.

**** From 1917 to 1932, all industry was subordinate to the Supreme Council of National Economy of the USSR.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

ministries.* The administration of production of locomotives passed to what was called the Ministry of Transport Machine Building through the following chronological sequence 2/:

<u>Period</u>	<u>Organization</u>
1932-37	Peoples Commissariat of Heavy Industry
1937-39	Peoples Commissariat of Machine Building
1939-41	Peoples Commissariat of Medium Machine Building
1941 - October 1945	Peoples Commissariat of the Tank Industry
October 1945 - March 1946	Peoples Commissariat of Transport Machine Building
March 1946 - March 1953	Ministry of Transport Machine Building
March 1953 - February 1955	Ministry of Transport and Heavy Machine Building
February 1955 - 10 May 1957	Ministry of Transport Machine Building

Since 10 May 1957 the plants producing locomotives have been subordinate to the Councils of National Economy of the regions in which they are located.

A. Diesel Locomotives.

At present the chief Soviet plants engaged in the program for production of main-line diesel locomotives are the Transport Machinery Plant at Bryansk, the V.A. Malyshev Transport Machine Building Plant at Khar'kov, the Diesel Locomotive Plant imeni Kuybyshev at Kolomna, and the Lugansk Locomotive Building Plant imeni October Revolution,** all of which are in the European USSR. These plants began production

* The Plant imeni Budenny at Novocherkassk, 1 of the 2 locomotive plants which now produce main-line electric locomotives, was subordinate to the Ministry of the Electrotechnical Industry. The Tbilisi Electric Locomotive Building Plant, formerly a repair shop of the Ministry of Railroads, is subordinate to the Council of National Economy in the Georgian SSR.

** For a photograph of the Lugansk Locomotive Building Plant imeni Kuybyshev, see Figure 1, following p. 6. Before 5 March 1958, Lugansk was known as Voroshilovgrad. 10/

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L.

of steam locomotives before 1900. The plants at Bryansk, Khar'kov, and Lugansk suffered extensive damage during World War II and were reconstructed after the war. Additional construction has taken place at all plants, especially recently, in connection with the conversion of the plants to production of the new diesel locomotives. A brief resume of the history of production of the plants follows. (For locations of the plants, see the accompanying map, Figure 2.*)

1. Transport Machinery Plant at Bryansk.

The Transport Machinery Plant at Bryansk began producing steam locomotives in 1890, was evacuated during World War II, and was reconstructed after 1943 to produce steam locomotives. In 1949 the plant began production of refrigerator cars and has produced railroad equipment as well as other types of freight cars and other types of equipment, such as mobile power units, tractor parts, and turbines. In December 1955 the plant reportedly was engaged in production of parts of the TE-3 (TЭ-3)** diesel locomotive although at present it is not itself assembling main-line diesel locomotives.

2. V.A. Malyshev Transport Machine Building Plant at Khar'kov.

The V.A. Malyshev Transport Machine Building Plant at Khar'kov produced Soviet steam locomotives, beginning in 1895, and has been producing diesel locomotives since 1947 -- the TE-1, the TE-2,*** and the TE-3 types. The plant also has designed and produced other types of diesel locomotives, including a new passenger locomotive, the TE-7.**** At present the plant has 63 continuous lines equipped with "high-productivity" equipment for parts for diesel locomotives. In 1955 it produced 134 diesel locomotives and in March 1957 its 1,000th postwar diesel locomotive. At one time it was engaged in designing a GT locomotive, and it also may be producing T-54 tanks.

* Inside back cover.

** The TE-3 diesel locomotive is produced in 2 or 3 sections with 2,000 horsepower (hp) each, any of which is capable of use as a separate locomotive. Therefore, throughout this report, for the purpose of measuring production, each section of the TE-3 locomotive is counted as one locomotive. For photographs of selected types of main-line locomotives in the USSR, see Figures 5 through 13 in Appendix D, following p. 48.

Soviet locomotive series are designated by letters of the Cyrillic alphabet on the basis of the history of the locomotive, the plant or its designer, a planner, and the like. The locomotive series Shch (Щ), for example, was produced according to the design of Professor Shchukin.

*** The TE-2 diesel locomotive is produced in 2 sections with 1,000 hp each, neither of which is capable of use as a separate locomotive. Therefore, throughout this report, for the purpose of measuring production, the 2 sections of the TE-2 locomotive are counted as 1 locomotive.

**** The TE-7 diesel locomotive is produced in 2 sections with 2,000 hp each, either of which is capable of use as a separate locomotive. Therefore, throughout this report, for the purpose of measuring production, each section of the TE-7 locomotive is counted as one locomotive.



Figure 1. USSR: Interior of the Lugansk Locomotive Building Plant imeni October Revolution

C-O-N-F-I-D-E-N-T-I-A-L

3. Diesel Locomotive Plant imeni Kuybyshev at Kolomna.

The Diesel Locomotive Plant imeni Kuybyshev . . Kolomna has been producing locomotives continuously since 1869 with the exception of the war years and has produced more than 10,400 locomotives. Since 1932 this plant has participated in production of diesel and electric locomotives although it actually has produced relatively few of these types. In 1954, Kolomna and the Lugansk Locomotive Building Plant imeni October Revolution together produced 758 steam locomotives. Kolomna has been and still is the most important producer of diesel engines for the Soviet Navy. At present the plant is engaged in the design and production of one of the first Soviet GT locomotives, and an All-Union Institute for Research in Internal Combustion Locomotives was to have been set up at the plant during 1956.

The plant had started production of TE-3 diesel locomotives by January 1956.

4. Lugansk Locomotive Building Plant imeni October Revolution.

The Lugansk Locomotive Building Plant imeni October Revolution has been producing Soviet locomotives since about 1900. In addition to locomotives, the plant has produced heavy-duty freight cars and parts for tractors. By August 1955 the plant was installing new equipment and assembly lines, and the locomotive frame shop had completed parts for the first Lugansk TE-3 diesel locomotive. All parts of the TE-3 which require numerous operations are to be produced on automatic-flow production lines, and assembly of the locomotives is to take place on a conveyor line. This plant is scheduled to produce 55 percent of all the diesel locomotives to be produced in the USSR in 1960.

In addition to producing the TE-3 diesel locomotive, the plant was engaged in the design and production of a Soviet GT locomotive.

B. Electric Locomotives.

At present there are two plants in the USSR producing electric locomotives -- the Plant imeni Budenny at Novocherkassk and the Tbilisi Electric Locomotive Building Plant.

1. Plant imeni Budenny at Novocherkassk.

The Plant imeni Budenny at Novocherkassk was constructed in 1946-47 on the site of a half-destroyed shop for repair of steam locomotives. In April 1947 the plant produced its first main-line electric locomotive and has been producing this type of locomotive continuously

C-O-N-F-I-D-E-N-T-I-A-L

since.* From the end of World War II until the end of 1957 it was the only plant producing main-line electric locomotives in the USSR. In addition, the plant has produced industrial locomotives, consumer goods, and parts for agricultural machinery. The plant recently has been expanded.

2. Tbilisi Electric Locomotive Building Plant.

The Tbilisi Electric Locomotive Building Plant is the former locomotive repair plant of the Soviet Ministry of Transportation which was converted in 1957 for production of electric locomotives. It produced its first electric locomotive at the end of 1957 and is scheduled to produce 100 N-8 (H-8) electric locomotives by the end of 1960. The conversion of the repair shop to a producing plant [] obviates the need to build a new electric locomotive plant as required by the original Sixth Five Year Plan (1956-60).

50X1
50X1

C. Specialization and Cooperation of Plants.

Production of diesel locomotives is being reorganized under what the Soviet planners call "specialization and cooperation." Certain plants will specialize in production of particular parts for diesel locomotives and will supply these parts to other plants as well as to themselves for use in production of diesel locomotives. A list of plants known or planned to be engaged in this program follows:

<u>Name, Type, or Location of Producing Plant</u>	<u>Part Produced</u>	<u>Location of Known or Planned Consumer</u>
Barnaul	Fuel circulation pumps	Khar'kov
Bryansk	Fuel tanks and other units	Khar'kov
Khar'kov, V.A. Malyshev Transport Machine Build- ing Plant	Fuel apparatus and regulators	Bryansk, Kolomna, and Lugansk
Khar'kov, V.A. Malyshev Transport Machine Build- ing Plant	Pistons and diesel generators	Kolomna

* The first Soviet electric locomotive was produced by the Moscow Dynamo Plant imeni Kirov in 1946. This plant has not produced any electric locomotives since World War II.

C-O-N-F-I-D-E-N-T-I-A-L

<u>Name, Type, or Location of Producing Plant</u>	<u>Part Produced</u>	<u>Location of Known or Planned Consumer</u>
Khar'kov, V.A. Malyshev Transport Machine Build- ing Plant	Diesel engines	Lugansk
Khar'kov, Plant of Diesel Locomotive Electrical Equipment	All electrical equipment (generators, traction motors, and the like)	Khar'kov
Kirov Metallurgical Plant	Rolled metal	Khar'kov
Kolomna	Cylinder blocks and connecting rods	Khar'kov
Kolomna	Blowers	Penza
Kolomna	Diesel engines	Lugansk
Kurgan	Diesel engines	
Lugansk	Running parts	Bryansk, Kolomna, and Khar'kov
Lugansk	Diesel frames, reductors and body units, and carriage parts	Khar'kov
Makeyevka Metallurgical Plant	Rolled metal	Khar'kov
Stalino Metallurgical Plant	Rolled metal	Khar'kov
Sverdlovsk, Turbomotor Plant	Blowers	Khar'kov
Tartu, "Teploavtomat"	Thermorelays	Khar'kov
Tomsk	Tachometers	Kolomna
Zaporozh'ye Metallurgical Plant	Rolled metal	Khar'kov

C-O-N-F-I-D-E-N-T-I-A-L

Dependence on other plants for semifinished and finished parts and assemblies has been the major problem of the Soviet plants producing locomotives. These goods in the past often have been of poor quality, have been late in arriving, or have not been received at all. Any of these deficiencies easily could wreck the plan for production of locomotives. The locomotive plants have attempted to produce as many parts of the locomotive as possible in order to avoid dependence on other plants for supplies. Therefore, each plant tries to obtain heavy machinery, often involving large expenditures of capital, and produces parts in only relatively small quantities. Such vertical integration of production is economically unsound, but it often enables the plant to meet goals which otherwise would have been underfulfilled. Because the bonuses of the plant director and the workers are dependent on the fulfillment of the plan, it has been in their interests to continue this vertical integration of production as much as possible.

At present, at least 15 plants are taking part in the program of "cooperation and specialization" for production of diesel locomotives. Most of the plants engaged in the program for production of diesel locomotives have complained about the quality, the time of arrival, or the lateness of the goods which they have been scheduled to receive under this program.

IV. Production.*A. Before World War II.

As a result of World War I, of the Russian Revolution, of foreign intervention, and of the Civil War, Russian industry and the system of rail transport were in a very poor condition when the Communists succeeded in achieving full control over the country. It is estimated that of the steam locomotives within the Soviet borders only 40 percent were in working condition. The other locomotives were uneconomical to use and needed capital repairs. The park of steam locomotives consisted of outmoded types, and the most powerful locomotive of the time, the series E (Э) locomotive, amounted to about 4 percent of the total park. 11/

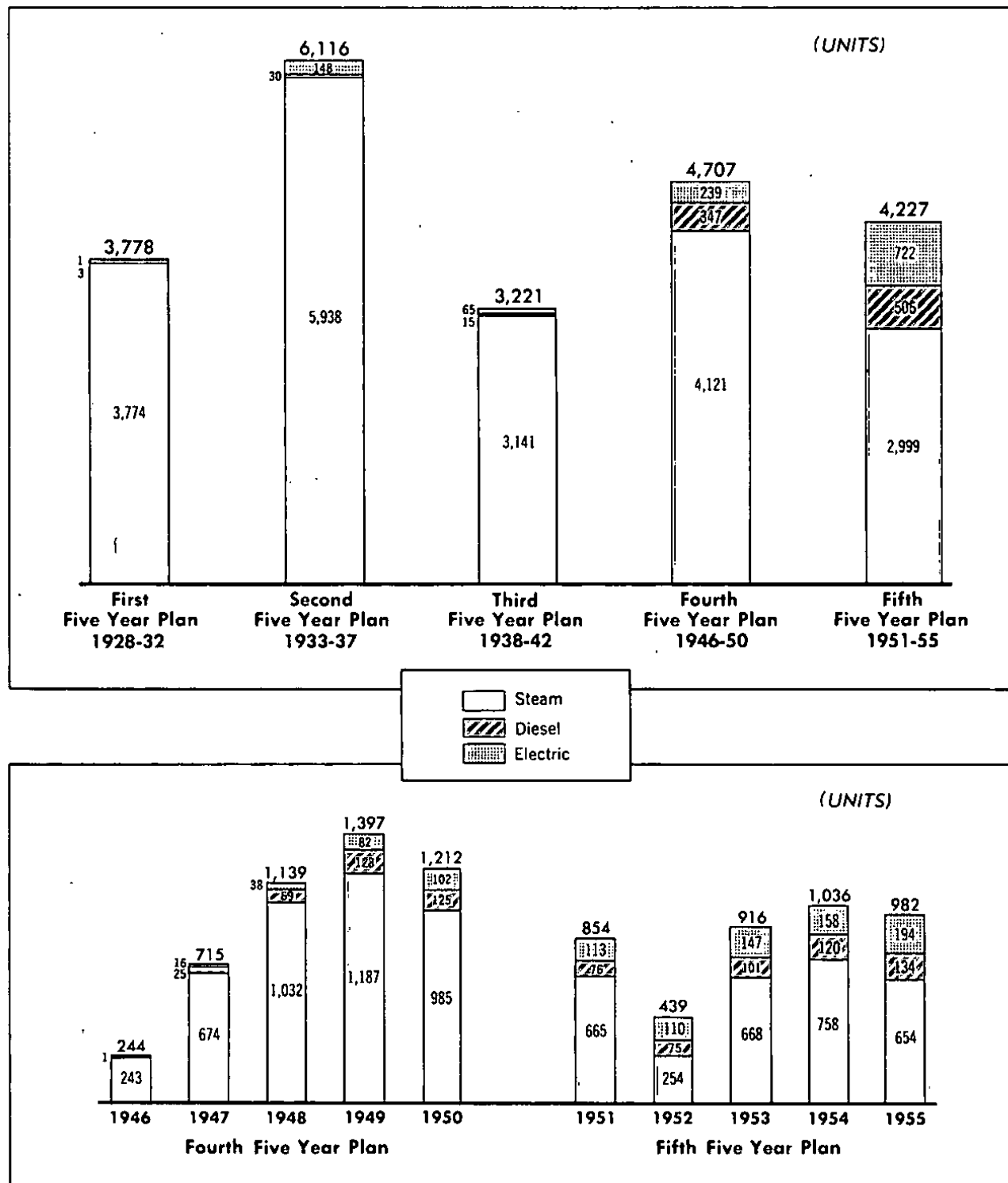
In 1925 the Fourteenth Congress of the Communist Party in its program for industrialization of the country provided for the creation of important metallurgical and machine building industries. The steam locomotive industry was expanded by this program and produced a large number of very much improved freight and steam locomotives -- a total of 4,370 steam locomotives from 1925 to 1932.

* See the accompanying charts, Figures 3 and 4, following p. 10, and Tables 7, 8, 9, and 10, Appendix B, pp. 38, 39, 40, and 41, respectively, below.

C-O-N-F-I-D-E-N-T-I-A-L

USSR

ESTIMATED PRODUCTION OF MAIN-LINE LOCOMOTIVES SELECTED YEARS, 1928*-55

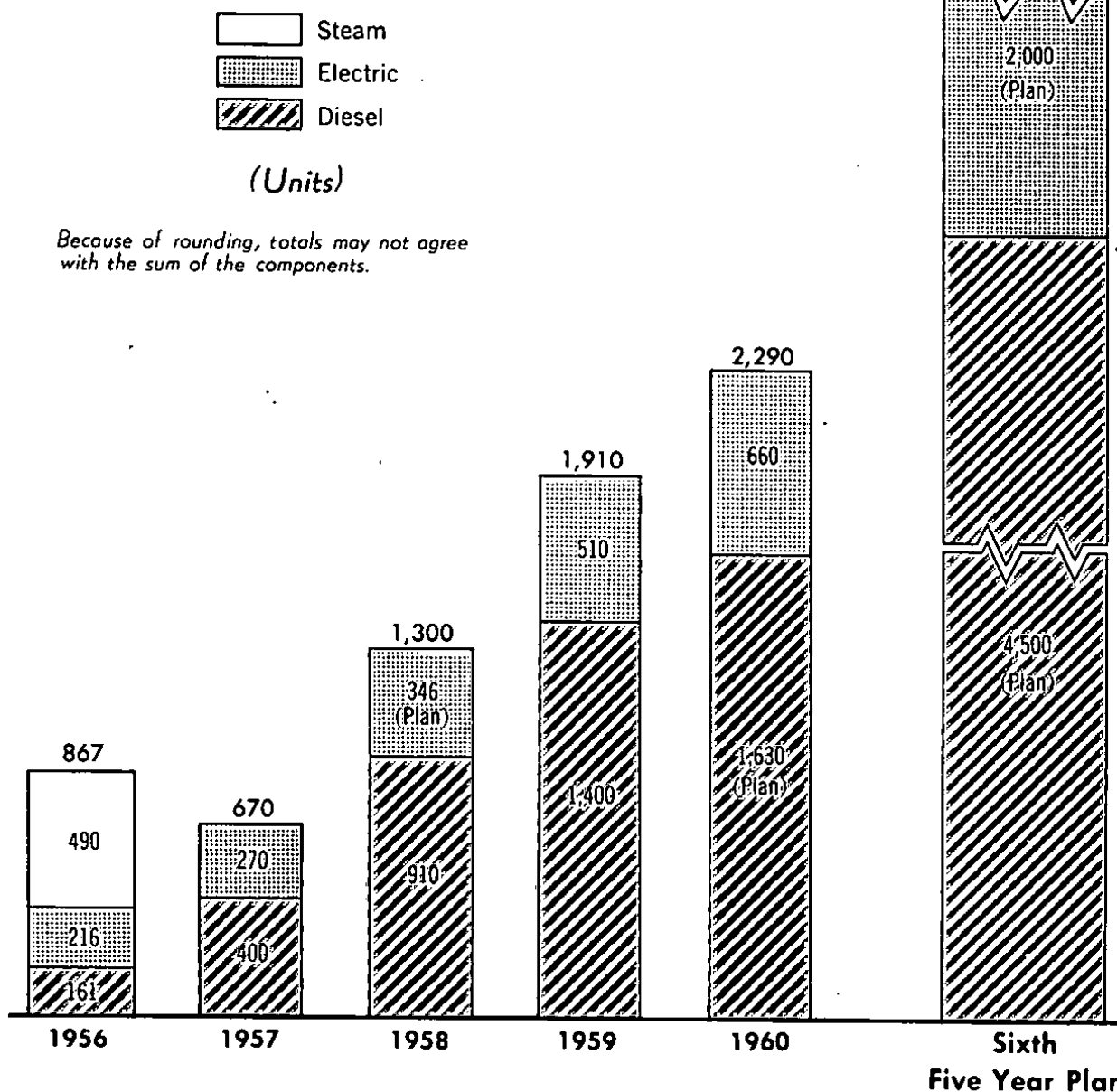


27237 12-58

*The year 1928 was selected as the first year of production because locomotives produced in the First Five Year Plan (1928-32) are still in operation in the USSR.

Figure 50X1

USSR: ESTIMATED PRODUCTION OF MAIN-LINE LOCOMOTIVES REQUIRED TO MEET THE GOALS OF THE ORIGINAL SIXTH FIVE YEAR PLAN, 1956-60



27238 12-58

50X1

C-O-N-F-I-D-E-N-T-I-A-L

During the first years of Communist power the Soviet steam locomotive plants produced a small quantity of steam locomotives of the 0-5-0* type (series E) with a top speed of 65 km per hour (hr) and a tractive force of 26,100 kilograms (kg) and several of the type 1-4-0 (series Shch), 13/ with a top speed of 75 km per hr and a tractive force of 21,400 kg. Subsequently, serial production of improved models of locomotives of the type 0-5-0 and finally 1-5-1 was organized.

All freight steam locomotives produced by the USSR during 1917-45 were simple two-cylinder machines which worked on superheated steam with the Walschaert's valve gear and with automatic air brakes. During this period the load on the rails per axle was increased from 16 to 20 tons, and horsepower was increased more than 100 percent.

From 1918 to 1941, steam locomotives were produced at the following plants: the Transport Machinery Plant at Bryansk, the V.A. Malyshev Transport Machine Building Plant at Khar'kov, the Diesel Locomotive Plant imeni Kuybyshev at Kolomna, the Krasnyy Putilovets Heavy Machine Plant at Leningrad, the Krasnoye Sormovo Plant at Gor'kiy, the Neva Plant at Leningrad, the Plant imeni Budenny at Novocherkassk, and the Locomotive Building Plant imeni October Revolution at Lugansk. The Krasnyy Putilovets Plant at Leningrad produced main-line steam locomotives from 1918 until 1930. The Neva Plant at Leningrad and the Plant imeni Budenny at Novocherkassk produced industrial types of steam locomotives.

By the end of World War I, production of passenger locomotives had ceased entirely and was not resumed until 1923, when the Krasnyy Putilovets Plant produced some 2-3-1 types of locomotives. Because of the complexity of these locomotives, however, only a small number were produced. The remaining locomotive plants at this time continued to produce freight steam locomotives of the 0-5-0 type (series E).

By 1925 a new passenger steam locomotive, the SU (CY), with 1,000 hp and a speed of 50 to 80 km per hr, was placed in series

* In this formula the first number indicates the number of leading (running) supporting axles, the second the number of driving axles, and the third the number of rear supporting axles. The numbers are separated by lines. In the absence of leading or rear supporting axles, 0 is used. 12/ Throughout this report, formulas for Soviet locomotive axles are used. These generally may be converted to formulas for US wheels by multiplying all numbers by 2.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

production. It is known that this locomotive was produced at the Krasnoye Sormovo Plant at Gor'kiy in 1934 and 1935 and at the Diesel Locomotive Plant imeni Kuybyshev at Kolomna until 1936. In 1932 the Kolomna plant produced the first of another model of passenger steam locomotive -- the JS (ЖС) -- which was placed in series production at Lugansk in 1936 and was produced until World War II. The JS locomotive, with 2,500 hp, had more than twice the power of the SU locomotive and a design speed of 115 km per hr.

By the time of the German invasion, in June 1941, the Soviet plants had renovated almost completely the park of steam locomotives. Steam locomotives of the FD (ФД),* JS, SO (СО), and E series made up about 75 percent of the park of steam locomotives,** several thousand of the locomotives being from 2 to 5 years old. 14/ Between 1927 and June 1941 the Soviet plants produced 12,853 steam locomotives. 15/

B. World War II.

Soviet production of main-line locomotives may be considered, for all practical purposes, as having ceased at the time of the German attack in June 1941, and production was not resumed until the end of hostilities. The Bryansk, Khar'kov, and Lugansk plants were in areas occupied by the Germans and largely were destroyed. 16/ Except for a few locomotives -- for example, a small number of locomotives of the Er (Эр***) series, produced by the Diesel Locomotive Plant imeni Kuybyshev at Kolomna in 1943-44 -- the locomotive plants were converted to production of war material or were evacuated. Evacuated personnel of the Khar'kov plant of the Ministry of Transport Machine Building, for example, mastered the mass production of T-34 tanks, 17/ and the Lugansk Locomotive Building Plant imeni October Revolution also was evacuated. 18/

Even during the war the Communists were planning for the resumption of production of locomotives in the prewar locomotive plants. In August 1943 the Government Committee of Defense adopted a decision to reconstruct the V.A. Malyshev Transport Machine Building Plant at Khar'kov and the Lugansk plant of the Ministry of Transport Machine Building, and, by the beginning of 1944, production had been started in both plants in a series of shops which previously had been destroyed completely by the Nazis. By autumn of 1945 the Lugansk plant had begun series production of locomotives with the first SO steam locomotive,

* A 3,000-hp locomotive with a speed of 85 km per hr.

** The locomotive park in the USSR as of 1938 is estimated to have been 23,689 locomotives.

*** The letter r indicated that this designation represented a redesigned version of the E series of steam locomotives.

C-O-N-F-I-D-E-N-T-I-A-L

a 96.5-ton locomotive with a top speed of 70 km per hr. 19/ During 1945, eight steam locomotives were produced.

C. Fourth Five Year Plan (1946-50).

At the beginning of the Fourth Five Year Plan most locomotives on the railroads of the USSR were steam locomotives, only a few hundred being electric and fewer than 100 being diesel locomotives. 20/

One of the goals of the first postwar Five Year Plan was stated to be the restoration and development of the national economy of the USSR. According to Voznesenskiy,*

To insure the outlined program of material production and construction work, the Five Year Plan provides for an increase in the amount of freight carried by railroad, water, and automobile transport from 483,000 million ton-kilometers in 1940 to 657,500 million ton-kilometers in 1950 -- that is, 36 percent above the prewar level ... ** 21/

In accordance with these tasks the Soviet locomotive industry was to have produced 6,165 steam locomotives, 555 electric locomotives, and 865 diesel locomotives during the Fourth Five Year Plan. For 1950, production of locomotives was to have included 2,200 steam, 300 diesel, and 220 electric locomotives. 22/ These goals meant that the major part of production of locomotives during the Five Year Plan was to come in the last year of the plan. More than one-third of the steam, almost one-third of the diesel, and almost one-half of the electric locomotives would have had to have been produced in 1950 if the plan were to have been met.

To aid in achieving the goals of the plan, production of main-line locomotives was to have been resumed at 3 locomotive plants and that of main-line steam and diesel locomotives and of steam and electric types of plant locomotives was to have been organized in 4 machine building plants, and new locomotive plants were to have been constructed and put into operation. 23/ Nine billion rubles were provided for the acquisition of rolling stock during the Fourth Five Year Plan. 24/

The plans for the first postwar Five Year Plan, however, were fulfilled only partly. Despite the fact that during the period of this

* Nikolay A. Voznesenskiy, then Chairman of Gosplan (State Planning Commission).

** For freight hauled by locomotives in the USSR, by type of locomotive, see Table 12 (Appendix C, p. 45, below).

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

plan there was a basic reconstruction of the plants producing steam locomotives -- especially the Transport Machinery Plant at Bryansk, the V.A. Malyshev Transport Machine Building Plant at Khar'kov, the Diesel Locomotive Plant imeni Kuybyshev at Kolomna, the Krasnoye Sormovo Plant at Gor'kiy, and the Lugansk Locomotive Building Plant imeni October Revolution -- production of locomotives subsequently was discontinued or decreased at many of these plants, and they were converted to production of other commodities, primarily goods for the "great projects of Communism." By 1955, only Kolomna and Lugansk still were producing steam locomotives.* 25/ Conversion of the locomotive plants to production of heavy equipment for hydroelectric projects, navigational canals, and other heavy industries reduced the number of locomotives which actually could be produced. In 1950, less than one-half of the planned locomotives of each type were produced: there were produced of the 2,200 steam locomotives called for by the plan, only 985; of the 300 diesel locomotives, only 125; and of the 220 electric locomotives, only 102. 26/ The plan for production in 1950, called for a total of 2,720 main-line locomotives, but only 1,212 locomotives were produced (see Table 7**), and the plan was underfulfilled by more than 1,500 locomotives.

D. Fifth Five Year Plan (1951-55).

In the draft of the Fifth Five Year Plan the USSR made no announcement regarding the number of locomotives to be produced during the period of the plan or during any year of the plan. Moreover, figures were not given for planned increase in production of locomotives in 1955 compared with 1950 as were given for almost all other major items of industrial production. 27/ This omission may have resulted from the program for production of locomotives still being unclear when the draft plan was submitted to the Nineteenth Party Congress (the draft was more than a year late). Production of locomotives during the previous Five Year Plan had been curtailed, and facilities for such production were used primarily for other projects. The plan stated, in regard to locomotives, only that the USSR must "fully meet the demands of rail transport in long-distance locomotives, electrically driven locomotives, and diesel locomotives ... and must begin production of ... electric locomotives, and diesel locomotives, including gas-generating locomotives." 28/ No figures were given. The curtailment of production of locomotives which began in the Fourth Five Year Plan continued during the first 2 years of the Fifth Five Year Plan, 1951 and 1952. No increase in production of steam and diesel locomotives was reported for these

* The Khar'kov plant concentrated on production of diesel locomotives in the postwar period.

** Appendix B, p. 38, below.

C-O-N-F-I-D-E-N-T-I-A-L

years. Although the goals of the 1951 annual plan were not publicized, it has been reported officially that production of locomotives exceeded the plan in that year. 29/ Production of electric locomotives increased in 1951 compared with 1950. In the announcement of the results of the 1952 annual plan, production of locomotives was not mentioned. 30/ It is now known that production of steam locomotives fell from a postwar high of 1,187 locomotives in 1949 to 985 locomotives in 1950, to 665 locomotives in 1951, and to only 254 locomotives in 1952. In only one other year during the Soviet Five Year Plans (not counting World War II) had production been lower: immediately after World War II in 1946 (243 locomotives). By 1953, production of steam locomotives again had risen slightly and was higher than the 1951 production by 668 locomotives.

Although Soviet designers and producers of locomotives have known that the steam locomotive is one of the most inefficient types, they produced this type rather than others because of conditions prevailing in the USSR. Among the factors which made the use of steam locomotives expedient were the level of workers' skills, the condition of the railroad system, and the relative availability of solid fuel compared with liquid fuel. As these factors changed, the conversion from steam to more efficient types of locomotives became a logical step. Electric locomotives require electric power (power which is also needed by industry in large amounts) and large investments of capital. Diesel locomotives, which require much smaller investments of capital, require a supply of diesel fuel. Of the two types of locomotives (electric and diesel) available to the USSR as alternatives to steam, the Soviet railroad men apparently decided that, on the basis of the geography of their country and other factors, diesel locomotives would be the better choice for the immediate future.

In the past, production of diesel locomotives in large numbers probably had been held back by the relative scarcity of diesel fuel. In a discussion of the Soviet railroad system in 1952, the statement was made that "a certain defect of locomotive traction is that the diesel locomotive expends expensive liquid fuel." 31/ With this problem in mind, Soviet researchers investigated the feasibility of a diesel locomotive which would work on a gas generator. "The solution of the problem of the gas-generator diesel locomotive will permit the use in them of hard fuel, which will widen the region of application of diesel locomotive traction."* 34/

* Research on the problem of a gas-generator diesel locomotive resulted in the TE-4 diesel locomotive. This locomotive produced gas from anthracite coal and burned it with liquid fuel in the ratio of 3 to 1. 32/ The TE-4 diesel locomotive [footnote continued on p. 16]

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

The need for diesel locomotives in the USSR was becoming more evident to the Soviet leaders. Kaganovich,* in a speech in May 1954, stated, "The steam locomotive park of the railroads has been significantly renovated. In 1953, 82 percent of all work was done by steam locomotives produced after 1935" 35/

At the same time, however, Kaganovich noted the need for types of locomotives other than steam as follows: "For 1956-60 we need to receive about 2,000 such diesels [as the TE-3 locomotive], 2,000 electric locomotives [such as the N-8 locomotive], and 6,000 steam locomotives." Kaganovich revealed that production of rolling stock had been reduced in previous years: "Unfortunately, the Ministry of Transport and Heavy Machine Building in the course of recent years has reduced production of rolling stock. At the present moment the Ministry of Transport Machine Building has been reestablished again, and it is possible to hope that the Ministry will turn its plants to face their long-established customer, rail transport." This statement seems to explain why no increases of production in comparison with the preceding years were announced for production of steam locomotives in 1951 and 1952: production of locomotives had been cut because facilities for production of locomotives were used for other types of production.

For some time after this speech the Soviet leaders still referred to the necessity of producing steam locomotives. By September 1955, however, perhaps noting the rapid transition of the US railroads to diesel locomotives because of their economic advantages, the Central Committee of the Communist Party of the USSR and the Council of Ministers of the USSR decided to transfer a series of plants of transport machine building to production of diesel

is produced in 3 sections with a total of 2,000 hp, none of which is capable of use as a separate locomotive. Therefore, throughout this report, for the purpose of measuring production, the 3 sections of the TE-4 locomotive are counted as 1 locomotive. As far as is known, only one TE-4 has been produced. The USSR still was working on the problem of using solid fuel in gas-generator locomotives in 1956. 33/

* Lazar M. Kaganovich, at that time First Deputy Minister of the Council of Ministers of the USSR.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

locomotives.* 37/ It was probably on about the same date that the decision was reached to end production of steam locomotives by 1957.

The decision to end production of steam locomotives had an immediate effect on production during the Fifth Five Year Plan. Indeed, from the evidence available it seems likely that the decision to end production of steam locomotives was taken some time before September 1955 (although it was not confirmed officially until then), but it was not made before Kaganovich's speech of May 1954. Production of steam locomotives reached its highest point during the Fifth Five Year Plan, in 1954. In 1955, however, production of steam locomotives decreased to 86 percent of that in 1954. 38/

E. Original Sixth Five Year Plan (1956-60).

Although the original Soviet Sixth Five Year Plan has been discarded in favor of a revised plan for 1959-65, it is believed that the requirements of rail transport during the period covered by the original Sixth Five Year Plan will not be changed greatly. Because requirements for rail transport are expected to remain fundamentally the same, it has been assumed that requirements for production of locomotives as set forth in the original Sixth Five Year Plan also will remain substantially unchanged.

The original Sixth Five Year Plan showed a fundamental shift in the emphasis placed on the type of locomotive to be produced in this period compared with locomotives under other Five Year Plans. 39/ Whereas in other Five Year Plans the steam locomotive was to be produced in far greater numbers than diesel and electric locomotives combined, in the original Sixth Five Year Plan the situation was completely reversed: no more than 1 in every 14 locomotives planned

* The following statement was made in the Soviet press: "The fuel balance of our country gives the possibility of wider application of diesel locomotives. The oil extraction industry has developed with such fast tempos that now it appears expedient on a series of lines even to convert part of the steam locomotives from coal burning to oil On diesel locomotive traction in 1954 there was expended a total of only 3.1 percent of the diesel fuel produced in the country. Considering the further development of the extraction of oil, it is possible confidently to say that the conversion even of a significant part of transport to diesel locomotive traction will not increase the expenditure of diesel fuel above 8 to 10 percent of its production." 36/ The ability of the Soviet oil industry to produce diesel fuel eliminated one of the most important obstacles to the further introduction of diesel traction in the USSR.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

for production was to be a steam locomotive.* This shift reflects the decision taken earlier by the Central Committee of the Communist Party of the USSR and the Council of Ministers to transfer certain plants of the Ministry of Transport Machine Building to production of diesel locomotives and the decision to end production of steam locomotives by 1957.**

It has been estimated that as a result of the increase in the use of diesel and electric locomotives to haul freight on the railroads of the USSR from 14 percent of the total hauled in 1955 to a planned 42.5 percent in 1960, rail transport in 1960 would require (in conventional units***) no more fuel than was required in 1955. This consumption of fuel is to be accomplished with an increase of 42 percent in the movement of freight. The expenditure of conventional units of fuel per unit of freight hauled under the Sixth Five Year Plan is to be decreased at least 30 percent, a saving in 1960 alone of the equivalent of more than 50 million tons of coal.**** The average requirement for fuel and energy of rail transport expressed as a percentage of total fuel and energy used in the USSR is to be reduced from 19.2 percent in 1955 to 12.2 percent in 1960. 41/

The original Sixth Five Year Plan called for the Ministry of Transport Machine Building to supply the railroads during the plan period with no less than 2,000 electric locomotives, including 400 eight-axle electric locomotives, and 4,500 main-line diesel locomotives. Part of the increase in production was to come from the conversion of the steam locomotive plants in Lugansk and Kolomna to production of diesel locomotives and part from an increase in the efficiency of labor. No figure was given for steam locomotives, but no more than 490 were produced during the plan period.

The plan also required the creation of a GT locomotive and the design and production in 1956-57 of experimental types of freight diesel locomotives with power of 2,500 to 3,000 hp in 1 section and of new types of passenger diesel and electric locomotives. In

* For estimates of production of locomotives during the period of the original Sixth Five Year Plan, see Table 9 (Appendix B, p. 40, below). For percentage of freight hauled by locomotives in the USSR, by type of locomotive, during selected years, 1950-70, see Table 12 (Appendix C, p. 45, below).

** See D, above.

*** The "conventional unit" used to measure the heat value of fuel in the USSR is equal to 7,000 calories.

**** In 1954, steam locomotives burned 70.6 million tons of hard coal, approximately 20 percent of the total extracted. 40/

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

addition, there is to be started series production of main-line electric locomotives which will operate on lines carrying alternating current of industrial frequency. 42/

The USSR should have no difficulty fulfilling the goals of the original Sixth Five Year Plan for production of diesel locomotives. All the plants which are to produce diesel locomotives have had many years of experience in producing locomotives, and most of them also have produced other heavy equipment -- for example, tanks, during World War II.

There is little doubt that the plan for production of electric locomotives also can be met. During the Fifth Five Year Plan, more than 700 electric locomotives were produced. To fulfill the goals of the original Sixth Five Year Plan, almost three times as many electric locomotives would have to be produced as in the period of the preceding plan. Additional facilities, however, are being constructed at the Plant imeni Budennyi at Novocherkassk and at the Tbilisi Electric Locomotive Building Plant, and with these facilities production can be increased. Moreover, about one-half of the increase was to come from better organization of production and utilization of available facilities. 43/ Some of this additional increase could come from the curtailment of production at the Novocherkassk plant of items other than main-line electric locomotives.

The director of the Novocherkassk plant seems confident that the original plan for electric locomotives will be fulfilled and even exceeded. In an article in the Soviet press he wrote as follows:

There is no doubt that the planned task for the development of electric locomotive building will be fulfilled. But it seems possible to us to increase still more production of electric locomotives, which would result in a reflection in the draft directives of the Five Year Plan.* This would require organizing cooperation with the Voroshilovgrad Locomotive Building Plant, the collective of which would be able to provide production of the mechanical parts of electric locomotives. In the case of such cooperation, production of main-line electric locomotives at the end of the Sixth Five Year Plan may reach 1,000 units a year instead of the 550 provided for by the draft of the Five Year Plan. Capital

* This sentence appeared in heavy black type in the original.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

expenditures on reconstruction of the plant, moreover, will not increase, and the cost of an electric locomotive will be reduced by 35 to 40 percent. 44/

It is estimated that in order to meet the planned goals for 1956-60, production of electric locomotives in the USSR should attain 660 units in 1960.

The statement that the Novocherkassk plant alone, under the condition given above, could produce almost twice as many locomotives as planned for 1960 indicates that no difficulty is anticipated in meeting the goals of the plan, particularly in view of the fact that it was planned to construct a second electric locomotive plant during the period of the original Sixth Five Year Plan and that the new plant should begin production during the period.

That new construction and reorganization of production has been taking place at all locomotive plants also seems to indicate that the USSR should have no trouble meeting, and perhaps exceeding, the over-all plan for production of locomotives during the Sixth Five Year Plan. The head of the Omsk Railroad System, for example, has said,

It seems to me that the plants producing locomotives have the possibility of technologically equipping the Omsk and other freight-dense mainlines at a faster tempo than is provided by the plan. It is necessary only to use more fully the reserves of industry. Now three of the most powerful steam locomotive plants -- Lugansk, Bryansk, and Kolomna -- are transferring to production of diesel locomotives. It seems that these plants plus the Khar'kov plant of the Ministry of Transport Machine Building will produce in the course of the Five Year Plan approximately 1.5 diesel locomotives per day. Isn't that too small for such powerful enterprises? The same may be said about electric locomotives In my opinion, it is expedient to increase the base of new production of locomotives by means of utilizing the principles of cooperation and specialization of parts and the capacity of the Ulan-Ude, Sverdlovsk, Novosibirsk, and certain other plants for repair of steam locomotives. 45/

C-O-N-F-I-D-E-N-T-I-A-L

In spite of the optimism of Soviet producers of locomotives and of railroadmen, it now appears that the USSR may have some difficulty in producing the number of diesel and electric locomotives required by the original Sixth Five Year Plan. This difficulty is not a result of necessary capacity not being available in the USSR to produce the planned number of locomotives. The USSR could produce the planned number of locomotives if steps were taken to improve the system of supply and the methods of production. Suggestions regarding such improvements have been made already by Soviet producers of locomotives and by railroadmen, but it remains to be seen to what extent these improvements will be carried out.

1. Diesel Locomotives.

The Soviet plan for production of diesel locomotives during 1956-60 was for 2,250 two-section locomotives, or 4,500 locomotives.* There were produced 161 sections in 1956 and 400 in 1957. Planned production for 1960 is 1,630 locomotives, leaving a total of approximately 2,300 locomotives to be produced in 1958 and 1959, or an average of about 1,160 per year. It has been estimated that production in 1958 and 1959 should be about 910 and 1,400 locomotives, respectively, or that production of diesel locomotives in 1958 must be more than double that in 1957 and in 1959 more than triple that in 1957 if the goals previously set forth are to be achieved.

Although it is usually possible to increase production of new products rapidly in the first years of production, it becomes exceedingly difficult to continue to increase production at the same rate without also increasing capital investments. Apparently no further major capital investments for the existing diesel locomotive plants are planned. At the same time, these plants evidently are not meeting current yearly plans for annual production. In 1957, production of diesel locomotives was about 2.5 times that in 1956, but plans for shipments of diesel locomotives to the Ministry of Transportation were underfulfilled by 40 locomotives. In 1958 this shortage of 40 locomotives will not be made up. The plan for 1958 apparently was reduced by another 100 diesel locomotives and is now set at approximately 750 locomotives. 46/

A plan goal of 750 locomotives for the 3 diesel locomotive plants appears to be low. This goal was reduced from the

* The TE-3 and TE-7 diesel locomotives are produced in 2 or 3 sections with 2,000 hp each, any of which is capable of use as a separate locomotive. Therefore, for the purpose of measuring production, each section of the TE-3 and TE-7 locomotives is counted as one locomotive.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

original goal at the request of the plant managers over the protests of the Ministry of Transportation. It is possible that the plant managers requested the reduction so as to be able to increase their bonuses by showing at the end of the year overfulfillment of plans which would be greater than would have been possible under the original goals, although the original goals could have been met. One Soviet source states that the V.A. Malyshev Transport Machine Building Plant at Khar'kov and the Lugansk Locomotive Building Plant imeni October Revolution would produce 850 diesel locomotives in 1958. 47/ If these 2 plants can produce this number and if production of locomotives at the Diesel Locomotive Plant imeni Kuybyshev at Kolomna also is considered, total Soviet production of diesel locomotives during 1958 ought to be well above 900 locomotives.

Reports of production of diesel locomotives in the first quarter of 1958, however, seem to indicate that the plan for 750 locomotives may be fulfilled exactly or exceeded only slightly. These numbers would mean that production of 4,500 diesel locomotives during 1956-60 probably would not be possible unless other plants were brought into the program for production of diesel locomotives. It had been planned to convert the Transport Machine Building Plant at Bryansk to production of main-line diesel locomotives and a plant in Penza to production of diesel engines for diesel locomotives. That neither of these plants yet has been converted to such production may explain some of the inability of the diesel locomotive plants to produce according to plan. It is possible that either these plants or others will be converted during 1958-60, but there is no evidence available on this subject.

2. Electric Locomotives.

The original Soviet Sixth Five Year Plan called for production during 1956-60 of 2,000 electric locomotives and for the construction in the areas of Siberia and the Urals of a plant to produce electric locomotives. By the beginning of 1957 it was becoming clear that in spite of the previous optimism of its director, the Plant imeni Budennyi at Novocherkassk (then the only Soviet plant producing electric locomotives) would be unable by itself to meet the goals of the plan. At about the same time it was decided to convert the Tbilisi Locomotive Repair Plant to production of electric locomotives. 48/ In a report to the Supreme Council of National Economy, I.I. Kuzmin, Vice-Chairman of the Soviet Council of Ministers and Chairman of Gosplan, cited this conversion as an example of the conservation of capital investments by the economic councils in contrast with the old ministerial organizations. The decision, he said, obviated the need to construct a new plant. 49/

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

The choice of the Tbilisi plant, however, is not considered universally a fortunate one. Under the heading, "A Second Plant Is Needed," a Soviet newspaper stated in January 1958 that the Tbilisi plant was almost wholly dependent on Novocherkassk for parts which had to be transported thousands of kilometers. 50/ It further suggested that the Tbilisi plant be converted to production of spare parts for electric locomotives or to production of industrial machines. The Lenin Locomotive Repair Plant at Rostov is considered by both the management of the Novocherkassk plant and the Council of National Economy of its economic region a much better choice for production of main-line electric locomotives than the Tbilisi plant because it has the necessary cranes, is near the source of supply of metal, and easily could obtain experienced technical assistance from the Novocherkassk plant.

Total Soviet production of electric locomotives was 216 in 1956 and 270 in 1957. If the 346 electric locomotives which the Soviet railroads are scheduled to receive in 1958 represent total Soviet production of electric locomotives for that year, 1,168 must be produced during 1959 and 1960 to meet the plan, or an average of 584 per year. Therefore, unless Novocherkassk and Tbilisi together can more than double production of the highest year at Novocherkassk (270 units in 1957) in both 1959 and 1960, production of electric locomotives planned for 1956-60 will be underfulfilled.

V. Research and Development.A. Gas-Turbine (GT) Locomotives.

The directives of the Twentieth Party Congress provide for, along with the wide development of electric and diesel locomotives, production of the first domestic GT locomotives. 51/ Mass introduction of the GT locomotive is scheduled for the end of the original Sixth Five Year Plan (1956-60). 52/

Since 1955, three Soviet plants have been reported working on the development of a Soviet GT locomotive. These plants are the V.A. Malyshev Transport Machine Building Plant at Khar'kov, the Diesel Locomotive Plant imeni Kuybyshev at Kolomna, and the Lugansk Locomotive Building Plant imeni October Revolution. Khar'kov was reported to be engaged in drawing up plans for a GT locomotive in January 1955 53/ but as far as can be determined has not been mentioned as engaged in the development of GT locomotives since then. By October 1955, Lugansk was engaged in the design of a GT locomotive, 54/ and it was announced that it would switch to production of diesel and GT locomotives during the original Sixth Five Year Plan. 55/ In December 1955, Kolomna reported that in 1956 it would

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

begin production of a GT locomotive with a capacity of 6,000 hp, 56/ and it has worked out a technical design with the Moscow Higher Technical Institute imeni Bauman for a 2-section GT locomotive with a capacity of 6,000 hp.* 58/ The plans for the Kolomna GT locomotive were approved by the Technical Councils of the Ministry of Transport Machine Building and the Ministry of Transportation in March or April 1956. 59/

Although the USSR generally is behind the US in production of locomotives, it is possible that the USSR could surpass the US in production of GT locomotives by 1960.**

B. Atomic Locomotives.

On 23 March 1956 it was reported that 2 graduates of the Moscow Higher Technical Institute imeni Bauman had defended successfully before a state examination committee their thesis of a project for a 5,500-hp atomic freight locomotive. 60/ On 2 May 1956, Radio Moscow reported "working projects" for an atomic locomotive capable of running 50,000 miles without refueling, 61/ and on 12 May 1956, the Soviet press stated that Soviet engineers had designed a 5,500-hp atomic locomotive. 62/

The design project is only the first step on the way to the creation of a locomotive of the future, a locomotive of a new type. But without a doubt, this first step will be followed by others. Comrade Surovtsev, Professor of the Moscow Higher Technical Institute imeni Bauman, is continuing the work in this direction The new group of graduates in this year will continue to perfect the design of the machine to lighten its weight. We must hope that the scientists of transport will bring their store [of knowledge] to this new, but greatly promising, branch of technology. 63/

The Moscow Higher Technical Institute imeni Bauman long has been concerned with research on and development of locomotives. This

* The locomotives produced by the Lugansk Locomotive Building Plant imeni October Revolution have the same number of sections and the same capacity. 57/

** The first US GT locomotive was produced in 1948, and an initial order for 10 locomotives was placed in 1951. On 1 January 1956, 20 GT locomotives were in service and 15 on order.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

institute took part in research on and development of Soviet diesel locomotives, and, as has been noted above, has been engaged in a project on a GT locomotive.

In addition to the Moscow Higher Technical Institute imeni Bauman, at an institute in Khar'kov and possibly at institutes in other Soviet cities "preparations are being carried out for the development of a proyekt (project) of a locomotive with an atomic engine." 64/ The USSR also has kept current on research on atomic locomotives in other countries, having, for example, printed extracts from the US publication, Railway Locomotives and Cars of May 1954, which contained an article, "Design for an Atomic Locomotive." 65/

It is evident that the USSR is very much interested in the possibility of producing an atomic locomotive. In a speech on utilization of atomic energy in the USSR, I.V. Kurchatov of the Academy of Sciences of the USSR made the following statement:

More extensive use of atomic energy must be made in transportation. Work on atomic power installations not only for icebreakers but also for other ships as well and for aviation and land transportation should be extensively developed in the current Five Year Plan.

We must also give some thought to the organizational aspect of this matter. Whereas formerly the initiative in posing new tasks lay with scientists and engineers in the atomic industry, now the initiative should pass to engineers and designers in the Ministries of Shipbuilding, the Aviation Industry, and Transport Machine Building. 66/

There are two methods by which atomic energy can be used in rail transport: as the generating power for electrical energy to run electric trains and as direct power in a locomotive. As far as the future is concerned, atomic power probably will be used first for electrical energy although its use as direct power could have been given priority because of the implications of such use for propaganda purposes. The USSR is considering both methods. 67/

VI. Capabilities, Limitations, and Intentions.

It is the stated intention of the Soviet leaders to convert the railroads of the USSR from the use of steam locomotives to the use of other types of locomotives, predominantly diesel and electric.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

As is evident from the data on work done by locomotives, it is planned for steam locomotives, which did about 85.9 percent of the total work in 1955 (see Table 12*), to do about 60 percent of the work in 1960, with diesel and electric locomotives doing about 40 percent. Diesel and electric locomotives will accomplish 80 to 85 percent of the total by 1965 and 100 percent by 1970, with diesel locomotives doing about 40 percent of the total and electric locomotives doing the remaining 60 percent. The effect which these plans will have on production of locomotives is evident from the figures of the original Sixth Five Year Plan which show a great increase in production of diesel and electric locomotives planned for 1960 compared with production in 1955. Production of steam locomotives, which totaled 654 in 1955, was ended in 1956, and none were to be produced thereafter. Table 12 does not show work to be done by types of locomotives other than steam, diesel, and electric. The Soviet locomotive plants, however, currently are attempting to design and produce GT locomotives, and at least one source refers to their "mass introduction onto the railroads" by 1960. 68/ It may be that work of GT locomotives is included in work to be done by diesels in Soviet planning because both types of locomotives depend on liquid fuel.

It now appears that delays in plans for the expansion of plant facilities and inefficient use of completed facilities probably will prevent the USSR from meeting the goal of its original Sixth Five Year Plan for production of diesel locomotives. The completion of these facilities will provide the USSR with the capacity to meet the requirements of rail transport for diesel locomotives for some time after 1960.

It was planned that by 1970, electric locomotives would account for more than one-half of the total work done by locomotives in the USSR. The only two Soviet plants now producing electric locomotives are the Plant imeni Budennyy at Novocherkassk and the Tbilisi Electric Locomotive Building Plant. Although production is increasing, it will have to increase at a far more rapid rate than has been achieved to date if the USSR is to meet the goal of the original Sixth Five Year Plan for production of electric locomotives.

There has been some speculation on whether or not enough locomotives are to be produced between 1956 and 1960 to meet the needs of Soviet railroads during this transition period. [redacted] 50X1
[redacted] it has been calculated that the 2,000 electric locomotives and 4,500 diesel locomotives called for by the original 50X1
Sixth Five Year Plan would be equal to approximately 15,000 series E or 10,000 series FD steam locomotives. Such numbers would be equal to an annual production of locomotives greater than that ever achieved by Soviet plants in the past. This production, together with available

* Appendix C, p. 45, below.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

steam locomotives, probably will be capable of meeting the needs of the Soviet railroads during 1956-60, although at a lower operating efficiency than planned.

- 27 -

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

APPENDIX A

STATISTICAL TABLES
ON TRANSPORTATION IN THE USSR AND THE US

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 1
Estimated Freight Hauled in the USSR and the US
in Percentages a/
Selected Years, 1940-60

Type of Transportation	USSR c/					US d/			
	1940	1945	1950	1956	1960 e/	1940	1945	1950	1956
Railroad	89.6	92.2	89.5	88.5	86.0	63.3	68.7	57.5	49.0
Inland water	7.7	5.5	6.8	5.8	4.9	18.1	13.3	14.9	15.9
Motor vehicle	1.9	1.5	3.0	4.0	4.6	9.5	6.2	15.8	18.4
Pipeline	0.8	0.8	0.7	1.7	4.5	9.1	11.8	11.8	16.7
Total	100	100	100	100	100	100	100	100	100

a. 69/. Freight carried by air transport is not shown, because the volume is negligible.

b. Calculated from freight measured in ton-kilometers.

d. 71/

e. Extrapolated by continuing the current trend of transportation in the USSR.

50X1

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 2

Estimated Proportion of Passengers Hauled in the USSR and the US ^{a/}
by Type of Transportation
Selected Years, 1913-55

Type of Transportation	USSR					US		
	1913	1928	1940	1950	1955	1939	1950	1953
Railroad	91.1	91.1	92.2	89.5	83.1	64.2	46.2	41.7
Water ^{c/}	8.9	8.9	4.4	4.0	3.0	3.7	2.0	2.3
Motor vehicle ^{d/}	0	0	3.2	5.3	12.3	30.6	37.4	32.3
Air	0	0	0.2	1.2	1.6	1.5	14.4	23.7
Total	100	100	100	100	100	100	100	100

a. ^{72/}. The figures given for the US do not include travel by private conveyance, thus greatly reducing the figures for transportation by motor vehicles.

b. Calculated from passenger-kilometers.

c. Including maritime and inland water.

d. Including bus.

50X1

C-O-N-F-I-D-E-N-T-I-A-L

Table 3

Estimated Freight Hauled in the USSR and the US
in Ton-Kilometers
Selected Years, 1940-56

Type of Transportation	USSR <u>a/</u>					US <u>b/</u>				
	1940	1945	1950	1953	1956	1940	1945	1950	1953	1956
Railroad	415.0	314.0	602.3	798.0	1,079.1	601.2	1,074.8	917.5	938.2	988.4
Inland water	35.9	18.6	45.9	58.9	70.2	172.4	208.4	238.5	295.6	321.2
Motor vehicle	8.9	5.0	20.1	31.4	48.5	90.6	97.7	252.4	317.1	370.5
Pipeline	3.8	2.7	4.9	7.6	20.5	86.5	184.7	188.6	248.0	335.7
Air						Negligible	0.1	0.5	0.6	0.8

a. 73/ ☐ does not include freight by air transport.
b. 74/

50X1

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 4

Estimated Increase of Freight
Hauled by Main-Line Locomotives in the USSR a/
1950-57

<u>Year</u>	<u>As a Percentage of the Previous Year</u>	<u>Index of Growth (1950 = 100)</u>
1950	N.A.	100
1951	109	109
1952	109	119
1953	107	128
1954	106	136
1955	112	152
1956	108	164
1957 <u>b/</u>	108	177

b. 76/

50X1

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

APPENDIX B

STATISTICAL TABLES
ON PRODUCTION OF MAIN-LINE LOCOMOTIVES
IN THE USSR

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 5

Estimated Production of Main-Line Locomotives
in the USSR and the Soviet Bloc a/
1949-57

<u>Year</u>	<u>Units</u>	
	<u>USSR</u>	<u>Soviet Bloc</u>
1949	1,397	2,036
1950	1,212	1,822
1951	854	1,477
1952	439	1,028
1953	916	1,428
1954	1,036	1,608
1955	982	1,684
1956	867	1,566
1957	670	927

a. II/

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 6
Estimated Operating Costs of Main-Line Steam and Diesel Locomotives
in the USSR a/
1954

Item of Cost	Steam Locomotives		Diesel Locomotives	
	Rubles per Thousand Locomotive- Kilometers	Rubles per Ten Thousand Gross Ton-Kilometers b/	Rubles per Thousand Locomotive- Kilometers	Rubles per Ten Thousand Gross Ton-Kilometers b/
Salary of locomotive crews	1,692	18.5	1,120	11.9
Fuel	5,216	56.9	1,444	15.4
Terminal repairs	852	9.3	455	4.9
Lubrication and illumination	106	1.1	94	1.1
Total	<u>7,866</u>	<u>85.8</u>	<u>3,113</u>	<u>33.3</u>

a. 78/

b. The term gross ton-kilometers as used in this table includes not only the weight of the cargo and passengers but also the weight of the locomotives and cars.

C-O-N-F-I-D-E-N-T-I-A-L

Table 7

Estimated Production of Main-Line Locomotives
in the USSR ^{a/}
Selected Years, 1913-55

				Units
Year	Steam Locomotives	Diesel Locomotives ^{b/}	Electric Locomotives	Total
1913	<u>477</u>			<u>477</u>
First Five Year Plan (1928-32)	3,774	3	1	3,778
Second Five Year Plan (1933-37)	5,938	30	148	6,116
Third Five Year Plan (1939-41)	3,141	15	65	3,221
Total	<u>12,853</u>	<u>48</u>	<u>214</u>	<u>13,115</u>
Fourth Five Year Plan (1946-50)				
1946	243	0	1	244
1947	674	25	16	715
1948	1,032	69	38	1,139
1949	1,187	128	82	1,397
1950	985	125	102	1,212
Total	<u>4,121</u>	<u>347</u>	<u>239</u>	<u>4,707</u>
Fifth Five Year Plan (1951-55)				
1951	665	76	113	854
1952	254	75	110	439
1953	668	101	147	916
1954	758	120	158	1,036
1955	654	134	194	982
Total	<u>2,999</u>	<u>506</u>	<u>722</u>	<u>4,227</u>

b. The TE-2 diesel locomotive is produced in 2 sections with 1,000 horsepower each, neither of which is capable of use as a separate locomotive, whereas the TE-3 and TE-7 diesel locomotives are produced in 2 or 3 sections with 2,000 horsepower each, any of which is capable of use as a separate locomotive. Therefore, throughout this table, for the purpose of measuring production, the 2 sections of the TE-2 locomotive are counted as 1 locomotive, and each section of the TE-3 and TE-7 locomotives is counted as 1 locomotive.

50X1

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 8

Estimated Production of Main-Line Locomotives, Including Diesel Locomotives, in the USSR
Compared with New Main-Line Diesel Locomotives
Installed by Class I Railroads a/ in the US
1945-54

			Units
Year	USSR		US
	Locomotives of All Types <u>b/</u>	Diesel Locomotives <u>b/</u>	New Diesel Locomotives Installed by Class I Railroads <u>c/</u>
1945	8	0	786
1946	244	0	624
1947	715	25	1,328
1948	1,139	69	2,254
1949	1,397	128	2,827
1950	1,212	125	3,191
1951	854	76	3,490
1952	439	75	3,035
1953	916	101	2,122
1954	1,036	120	1,110
Total	7,960	719	20,767

a. The term Class I Railroad as used in this table refers to railroads having annual operating revenues of more than US \$1 million. 80/

b. 81/. The TE-2 diesel locomotive is produced in 2 sections with 1,000 horsepower each, neither of which is capable of use as a separate locomotive, whereas the TE-3 and TE-7 diesel locomotives are produced in 2 or 3 sections with 2,000 horsepower each, any of which is capable of use as a separate locomotive. Therefore, throughout this table, for the purpose of measuring production, the 2 sections of the TE-2 locomotive are counted as 1 locomotive, and each section of the TE-3 and TE-7 locomotives is counted as 1 locomotive.

c. 82/

C-O-N-F-I-D-E-N-T-I-A-L

Table 9

Estimated Production
of Main-Line Steam, Diesel, and Electric Locomotives
Required to Meet the Goals
of the Original Sixth Five Year Plan
in the USSR a/
1956-60

				Units
<u>Year</u>	<u>Steam Locomotives</u>	<u>Diesel Locomotives <u>b/</u></u>	<u>Electric Locomotives</u>	<u>Total</u>
1956	490	161	216	867
1957	0	400	270	670
1958	0	910 <u>c/</u>	346 (plan)	1,300
1959	0	1,400	510	1,910
1960	0	1,630 (plan)	660 <u>d/</u>	2,290
Total	<u>490</u>	<u>4,500 (plan) <u>e/</u></u>	<u>2,000 (plan)</u>	<u>7,000</u>

a. Figures for 1956 and 1957 indicate actual production for these years. The remaining figures are estimates of the number of locomotives which must be produced to meet the goals of the original Sixth Five Year Plan. (For Methodology, see Appendix D.) Because of rounding, totals may not agree with the sum of the components.

b. The TE-2 diesel locomotive is produced in 2 sections with 1,000 horsepower each, neither of which is capable of use as a separate locomotive, whereas the TE-3 and TE-7 diesel locomotives are produced in 2 or 3 sections with 2,000 horsepower each, any of which is capable of use as a separate locomotive. Therefore, throughout this table, for the purpose of measuring production, the 2 sections of the TE-2 locomotive are counted as 1 locomotive, and each section of the TE-3 and TE-7 locomotives is counted as 1 locomotive.

c. Planned to be 750 diesel locomotives in 1958.

d. Planned to be 550 electric locomotives in the original Sixth Five Year Plan.

e. The original Sixth Five Year Plan called for a total of 2,250 two-section diesel locomotives -- the equivalent of 4,500 units.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 10

Estimated Production of Main-Line Diesel Locomotives
in the USSR a/
1945-57

Year	Units			
	TE-1 Locomotives <u>b/</u>	TE-2 Locomotives <u>c/</u>	TE-3 Locomotives <u>d/</u>	Others
1945	0	0	0	0
1946	0	0	0	0
1947	25	0	0	0
1948	67	0	0	2 <u>e/</u>
1949	127	1	0	0
1950	80	45	0	0
1951	0	76	0	0
1952	0	74	0	1 <u>f/</u>
1953	0	99	2	0
1954	0	120	0	0
1955	0	132	2	0
1956	0	0	161	0
1957	0	0	400	0

a. For information on which this table is based, see Appendix D.

b. The TE-1 diesel locomotive is produced in 1 section of 1,000 horsepower.

c. The TE-2 diesel locomotive is produced in 2 sections with 1,000 horsepower each, neither of which is capable of use as a separate locomotive. Therefore, throughout this table, for the purpose of measuring production, the 2 sections of the TE-2 locomotive are counted as 1 locomotive.

d. Including the TE-7 diesel locomotive, which is the passenger version of the TE-3 diesel locomotive. The TE-3 and TE-7 locomotives are produced in 2 or 3 sections with 2,000 horsepower each, any of which is capable of use as a separate locomotive. Therefore, throughout this table, for the purpose of measuring production, each section of the TE-3 and TE-7 locomotives is counted as 1 locomotive.

e. TE-5 diesel locomotives, which are basically TE-1 locomotives.

f. TE-4 diesel locomotive. The TE-4 diesel locomotive is produced in 3 sections with a total of 2,000 hp, none of which is capable of use as a separate locomotive. Therefore, throughout this report, for the purpose of measuring production, the 3 sections of the TE-4 locomotive are counted as 1 locomotive.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

APPENDIX C

ADDITIONAL INFORMATION
ON PRINCIPAL TYPES OF MAIN-LINE LOCOMOTIVES
IN THE USSR

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 11

Estimated Basic Data on Principal Types of Main-Line Locomotives
in the USSR

Item	Unit	Steam Locomotives ^{a/}		Diesel Locomotives ^{b/}			Electric Locomotives ^{c/}				
		L	LV	TE-1	TE-2	TE-3	VL-19	VL-22m	VL-23	N-0	N-8
Year of production		1945 and 1948-54	1951 and 1954-56	1947-50	1948-55	1953 and 1955 to the present	1932 and 1934-38	1941 and 1946-58	1956	1954 and 1956 to the present	1953 and 1955 to the present
Load-pulling capacity	Metric tons	N.A.	N.A.	N.A.	N.A.	1,080	N.A.	N.A.	360	2,500	3,500
Service weight	Metric tons	N.A.	N.A.	123.9	85	126	117	132	138	132	180
Design speed	Kilometers per hour	80	80	90	93	100	85	75	90	85	90
Engine horsepower	Horespower	N.A.	N.A.	1,000	1,000	2,000	N.A.	3,260	4,300	3,200	5,700
Maximum horsepower on rim of wheels	Horsepower	2,100 to 2,200	2,600	765	755	1,600	N.A.	N.A.	N.A.	N.A.	N.A.
Strength of traction, hourly	Kilograms	N.A.	N.A.	N.A.	N.A.	N.A.	20,000	23,900	26,400	23,400	35,300
Strength of traction, continuous	Kilograms	N.A.	N.A.	N.A.	N.A.	N.A.	17,000	20,300	22,700	16,600	30,300
Type of current		N.A.	N.A.	N.A.	N.A.	N.A.	d.c. ^{d/}	d.c.	d.c.	a.c. ^{e/}	d.c.

a. ^{83/}
b. ^{84/}
c. ^{85/}
d. Direct current.
e. Alternating current.

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

Table 12

Estimated Freight Hauled by Principal Types of Main-Line Locomotives
in the USSR a/
Selected Years, 1950-70

				Percent <u>b/</u>
<u>Year</u>	<u>Steam Locomotives</u>	<u>Diesel Locomotives <u>c/</u></u>	<u>Electric Locomotives</u>	<u>Total</u>
1950	94.6	2.2	3.2	100
1955	85.9	5.7	8.4	100
1960 (plan)	57.5	21.4	21.1	100
1965 (plan)	15 to 20 <u>d/</u>	35 to 40 <u>e/</u>	45	100
1970 (plan)	0	41	59	100

b. Calculated from freight measured in ton-kilometers.

c. The figures shown for diesel locomotives, starting with 1960, may include work to be done by gas turbine locomotives because both types of locomotives operate on liquid fuel.

d. Computed as a remainder of 100 percent less the percentages for the other two types.

e. Total hauled by diesel and electric locomotives would be 80 to 85 percent. 87/ The figures given in the table for diesel locomotives were obtained by subtracting the known figures for electric locomotives.

50X1

C-O-N-F-I-D-E-N-T-I-A-L

C-O-N-F-I-D-E-N-T-I-A-L

APPENDIX D

PHOTOGRAPHS OF SOVIET MAIN-LINE LOCOMOTIVES

- 47 -

C-O-N-F-I-D-E-N-T-I-A-L

50X1

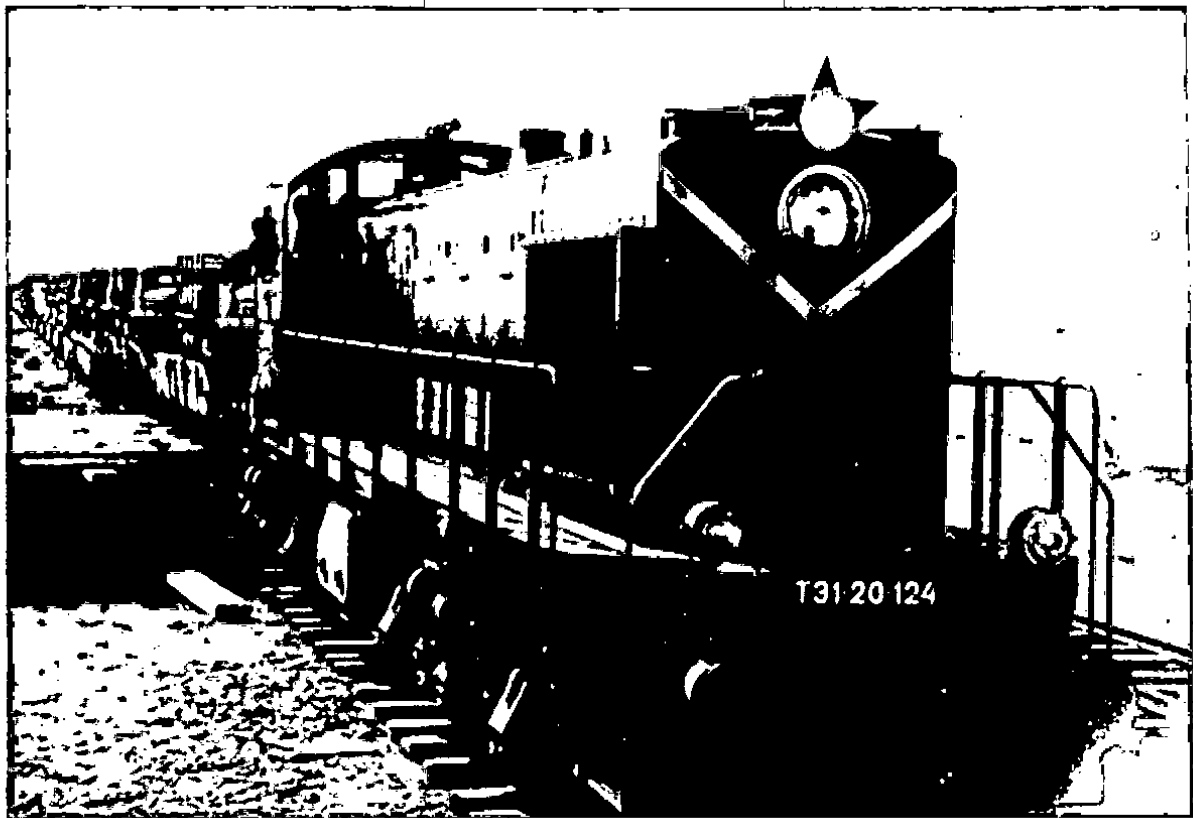


Figure 5. USSR: TE-1 Diesel Locomotive

50X1

50X1

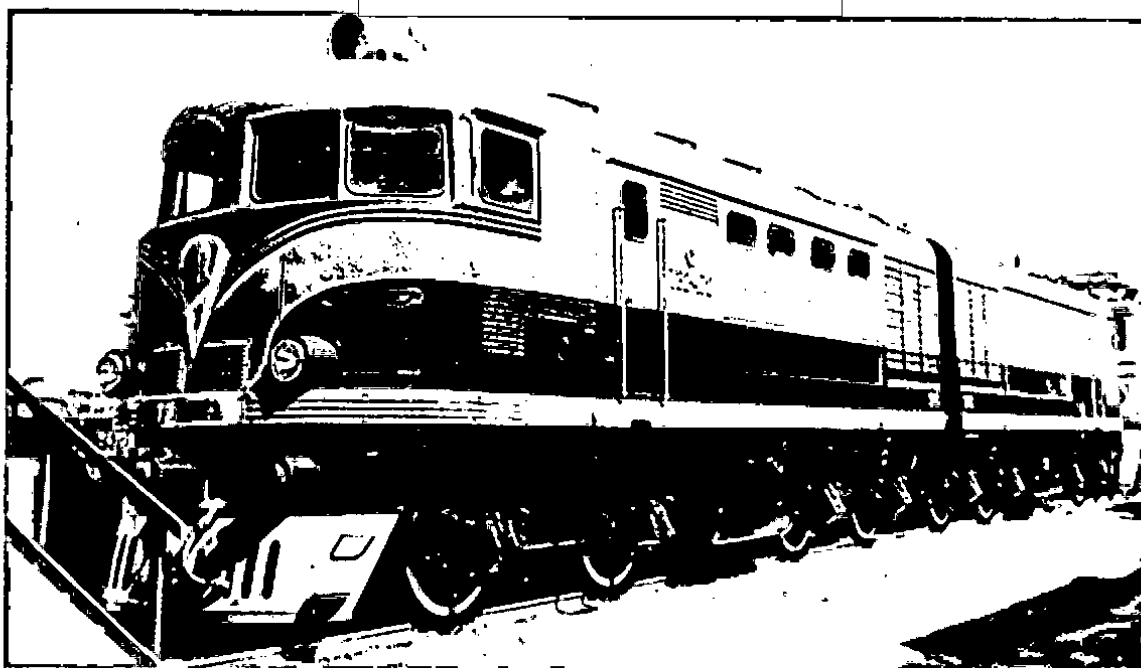


Figure 6. USSR: TE-2 Diesel Locomotive

50X1

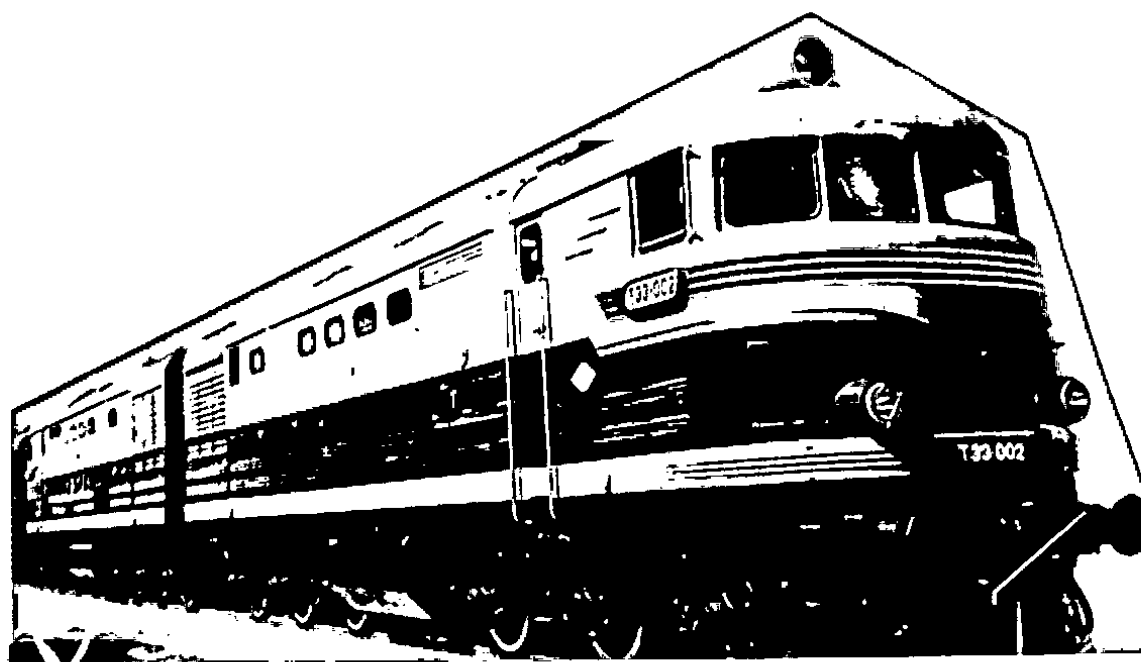


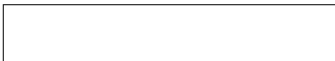
Figure 7. USSR: TE-3 Diesel Locomotive



50X1



Figure 8. USSR: VL-19 Electric Locomotive



50X1



50X1

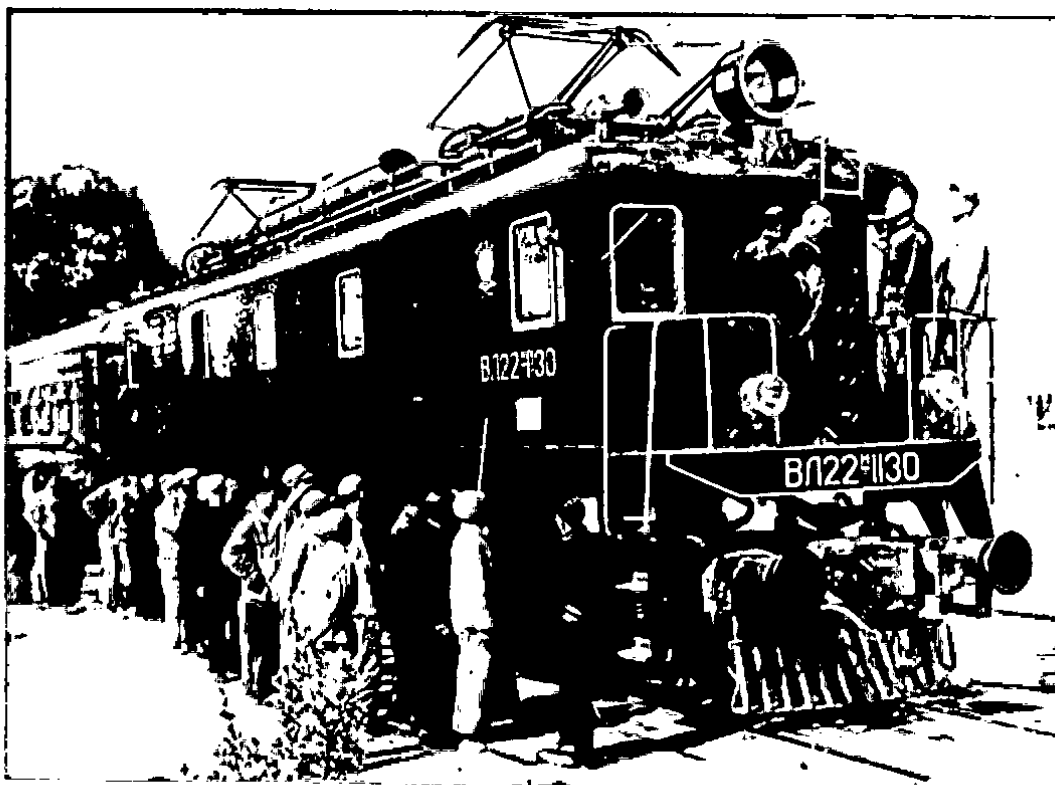


Figure 9. USSR: VL-22 m Electric Locomotive



50X1



50X1

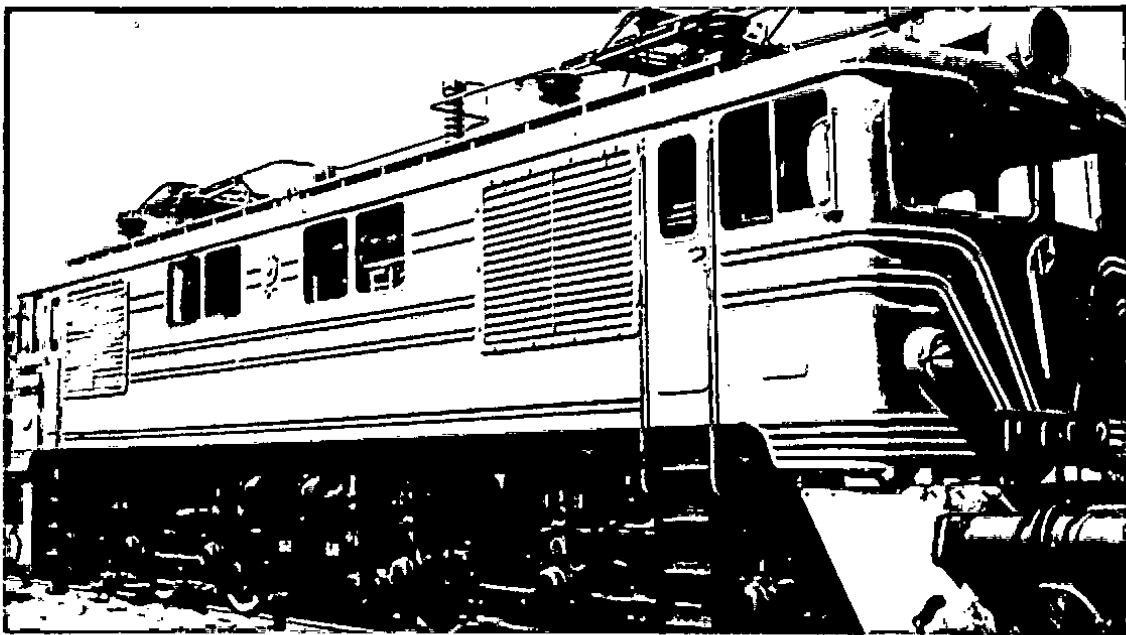


Figure 10. USSR: N-O Electric Locomotive

50X1



Figure 11. USSR: N-8 Electric Locomotive



50X1

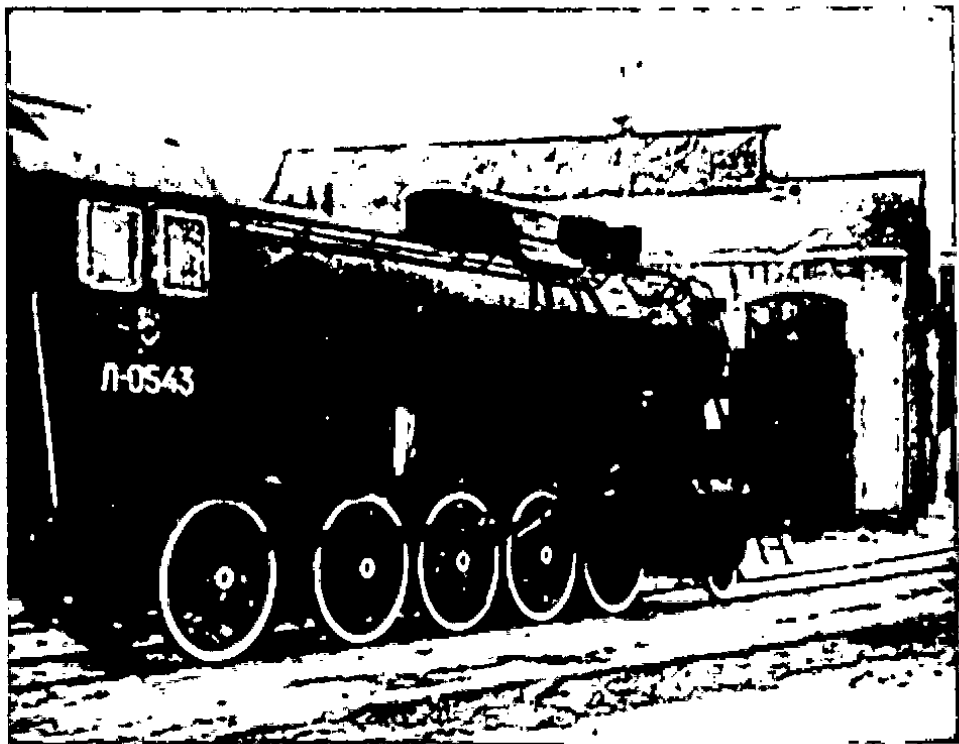


Figure 12. USSR: L Steam Locomotive



50X1

50X1

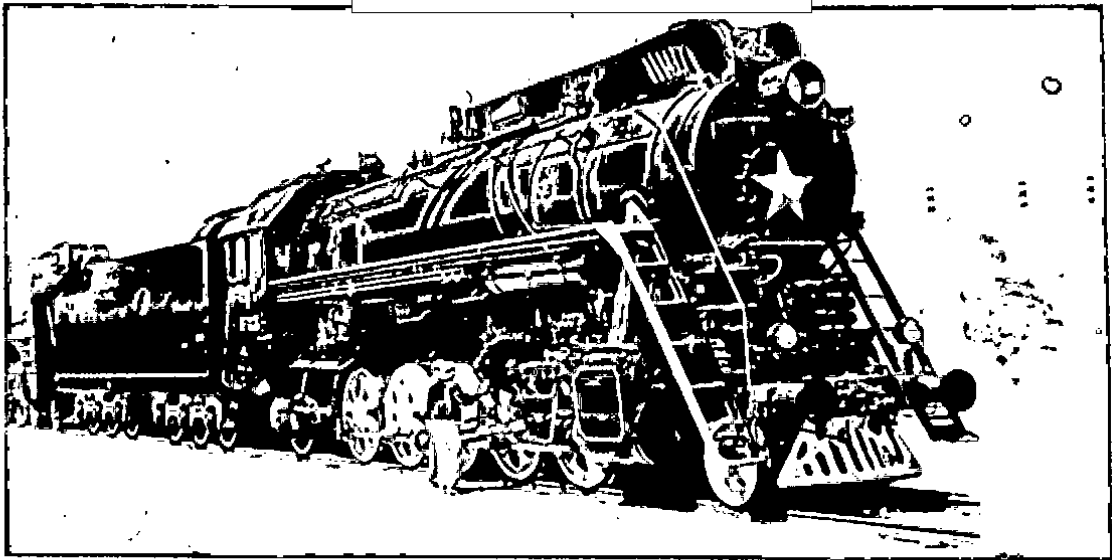


Figure 13. USSR: LV Steam Locomotive

C-O-N-F-I-D-E-N-T-I-A-L

APPENDIX E

METHODOLOGY1. Electric Locomotives, 1941.

The first Soviet postwar electric locomotive is known to be the VL (ВЛ)-22m-184. Assuming that all VL types of locomotives were numbered serially, the last prewar VL locomotive would have been number 183. It is also known that a VL-22-176 electric locomotive was produced in 1940, and by 1941 the VL-22-178 had been produced. These figures mean that the VL-22-177 was either the last one produced in 1940 or the first in 1941. It has been assumed that the VL-22-177 was the first produced in 1941. Therefore, production of VL locomotives in 1941 was 7 locomotives (177 through 183). Because the VL type was the only type of electric locomotive produced during 1941, this figure represents total production of electric locomotives for that year.

2. Diesel Locomotives, 1947-56.*a. 1947.

The only type of diesel locomotive in production in the USSR in 1947 was the TE-1.** Therefore, the 25 diesel locomotives produced in 1947 must have been this model. Production of TE-1 locomotives was continued through 1948-50. In 1948, two TE-5 locomotives*** were produced, but they are considered TE-1 locomotives for the purposes of this methodology.

b. 1948.

In 1948 the first TE-2 locomotive, a 2-section articulated diesel locomotive having 1,000 hp per section and a total of 2,000 hp per locomotive, was produced. This locomotive was the only TE-2 produced that year, and apparently it was not counted in production for 1948, possibly because it was an experimental locomotive and had not been transferred to the railroads. The 69 locomotives reported produced in 1948 had a total of 69,000 hp, indicating 1,000 hp per locomotive, or all TE-1 locomotives.

** The TE-1 diesel locomotive is produced in 1 section of 1,000 horsepower.

*** The TE-5 diesel locomotive is basically a TE-1 locomotive.

50X1

C-O-N-F-I-D-E-N-T-I-A-L

c. 1949.

The TE-2 diesel locomotive produced in 1948 was reported apparently in the figure for production for 1949. A second TE-2 was produced in 1947 but apparently was not reported in that year. Because 128 locomotives having 129,000 hp were reported produced in 1949, production must have been 127 TE-1 locomotives and 1 TE-2 locomotive.

d. 1950.

In 1950, production of TE-1 diesel locomotives was ended and that of the TE-2 begun. Because the combined production of TE-1 locomotives (1,000-hp locomotives) and TE-2 locomotives (2,000-hp locomotives), the total horsepower produced during 1950, and the horsepower of the two types are known, production, by model, was computed algebraically.

e. 1951-56.

From 1951 through 1956 the number of units of locomotives and the horsepower reported indicate that each unit was of 2,000 hp.* TE-2 diesel locomotives were known to have been produced through 1955, when their production was discontinued. These locomotives had 2 sections of 1,000 hp each, giving a total of 2,000 hp per locomotive. In 1953 the first TE-3 diesel locomotive was produced. This locomotive has 2,000 hp per section and usually is used as a 2-section locomotive having a total of 4,000 hp. Because it is known that each unit reported for 1953 had 2,000 hp, the TE-3 must have been reported in 2,000-hp sections with each section of 2,000 hp being counted as 1 locomotive. In 1954, total production consisted of TE 2 locomotives. By November 1955 it was reported that a second TE-3 had been produced, and it has been assumed that this locomotive was the only TE-3 produced in 1955.

It is assumed that production from 1956 to date has consisted of the TE-3 locomotive and its passenger version, the TE-7, and that these locomotives have been reported with each 2,000-hp section counting as 1 locomotive.

* It also has been assumed that the figure reported for 1955 for horsepower should be 268,000 because only TE-2 and TE-3 locomotives were produced during that year, and no logical combination of locomotive sections would give 134 units with a total of 266,000 hp.

C-O-N-F-I-D-E-N-T-I-A-L

3. Original Sixth Five Year Plan (1956-60).

a. Diesel Locomotives.

Subtraction of 161 diesel locomotives (production reported for 1956), 400 locomotives (production reported for 1957), and 1,630 locomotives (production planned for 1960) from 4,500 single-section locomotives (total production planned for 1956-60) yields approximately 2,300 locomotives to be produced in 1958-59. This remainder then was distributed between the 2 years, with the consideration that annual production during the period concerned probably will increase at a decreasing rate after the initial years of production.

b. Electric Locomotives.

Estimates of Soviet production of electric locomotives were made in a manner similar to those used in obtaining estimates of diesel locomotives.

Although in 1957 there was a conversion to production of electric locomotives of greater power, production was increased from 216 locomotives in 1956 to 270 in 1957. On the basis of announced production for these 2 years and total planned production for the original Sixth Five Year Plan, combined production for 1958-60 is estimated at 1,514 locomotives. This figure has been divided among the 3 years, with the consideration that production probably will increase more rapidly in 1958 than in 1959.

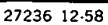
C-O-N-F-I-D-E-N-T-I-A-L

Page Denied

Next 5 Page(s) In Document Denied

50X1

USSR: Locations of Locomotive Plants and Component Supply Plants, 1958



CONFIDENTIAL

CONFIDENTIAL